REMARKS

Claims 1 – 27 are now pending in the application. The Examiner is respectfully requested to reconsider and withdraw the rejections in view of the amendments and remarks contained herein.

SPECIFICATION

The specification stands objected to for certain informalities. More specifically, the Examiner has objected to the title of the invention as being non-descriptive.

Applicants note that the title of the invention has been amended herein to clearly indicate the invention to which the claims are directed. Accordingly, reconsideration and withdrawal of the objection are respectfully requested.

CLAIM OBJECTIONS

Claims 13 and 26 stand objected to. More specifically, the Examiner has noted that the term "Kalman filter" should not be used to describe the filter because a trademark or a trade name is usually not permitted in a claim.

Applicants respectively note that the term "Kalman filter" is neither a trademark nor a trade name. The term "Kalman filter" describes a set of mathematical equations that enable estimation of a state of a process in a way that minimizes the mean of a squared error. The term "Kalman filter" refers to R. E. Kalman, the original publisher of this mathematical process.

Accordingly, reconsideration and withdrawal of the objections are respectively requested.

REJECTION UNDER 35 U.S.C. § 102

Claims 1 – 12 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Hoenig (U.S. Pat. No. 6,618,681). This rejection is respectfully traversed.

At the outset, Applicants note that claim 1 includes processing the linear equation through a time-varying state and parameter estimator based on the terminal current, the terminal voltage and the temperature to determine states and parameters of the electrochemical call (EC). Hoenig fails to teach or suggest processing the linear equation through a time-varying state and parameter estimator based on the terminal current, the terminal voltage and the temperature to determine states and parameters of the EC.

The method of the present invention enables estimation of the state and parameters of an EC based on terminal voltage and current, while the EC is used during normal operation. More specifically, the terminal voltage and current are monitored during operation. The linear equation, which models the EC, is processed through a time-varying state and parameter estimator based on the terminal voltage and current. The time-varying state and parameter estimator includes time update equations (predictor) and measurement equations (corrector). The time update equations project the current characteristic and error covariance estimates to obtain estimates for the next time step. The measurement update equations incorporate new measurements into the estimates to obtain an improved or updated estimate.

Hoenig discloses a system for predicting the amount of available energy in a battery. The system implements an equation that is derived based on a mathematical

analysis of parameters that are measured during testing of a particular battery F (Col. 4, Lines 53 – 58). In order to predict the remaining energy, the system of Hoenig interrupts regular operation of the battery during first and second stages. More specifically, in the first stage, a step or pulse charge current is applied from a power supply C to the battery F and the battery response voltage and response current are measured (Col. 5, Lines 2 – 10). In a second stage, a linearly increasing charge current from the power supply C is applied to the battery F, and the response voltage is measured. After the maximum current point of the positive ramp has been reached, the current is decreased with an equivalent negative value slope while the response voltage is continually measured (Col. 5, Lines 36 – 57). The available energy of the battery is predicted based on the numerical values of the parameters that are determined in stage 1 and 2 testing. The parameter values are inserted into the derived equation, the solution of which is the predicted available energy (Col. 7, Lines 28 – 34 and Equations (1) and (2)).

Because the system disclosed in Hoenig requires application of a step or pulse current in stage 1 and a linearly increasing/decreasing current in stage 2, normal operation of the battery must be interrupted to predict the remaining energy. Further, the current and voltage values obtained during stages 1 and 2 are simply plugged into the empirically derived equation whose solution is the remaining energy. Therefore, the equation is not processed through a time-varying state and parameter estimator based on the terminal voltage and current. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

With regard to claims 2 – 12, Applicants note that each ultimately depends from claim 1, which defines over the prior art, as discussed in detail above. Therefore, claims 2 – 12 also define over the prior art for at least the same reasons with respect to claim 1, and reconsideration and withdrawal of the rejections are respectfully requested.

REJECTION UNDER 35 U.S.C. § 103

Claims 13 – 27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hoenig (U.S. Pat. No. 6,618,681). This rejection is respectfully traversed.

As similarly described above with respect to claim 1, claims 13 and 26 each include processing the linear equation through a Kalman filter (KF)-based state and parameter estimator based on the terminal current, the terminal voltage, the temperature to determine the states and the parameters. Hoenig fails to teach or suggest processing the linear equation through a Kalman filter (KF)-based state and parameter estimator based on the terminal current, the terminal voltage and the temperature to determine the states and the parameters.

As discussed in detail above, Hoenig discloses a system for predicting the available energy in a battery by applying a step or pulse current in stage 1 and a linearly increasing/decreasing current in stage 2, whereby normal operation of the battery is interrupted. Further, the current and voltage values obtained during stages 1 and 2 are simply plugged into the empirically derived equation whose solution is the remaining energy. Therefore, the equation is not processed through KF-based (e.g., a time-varying) state and parameter estimator based on the terminal voltage and current. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

With regard to claims 14 – 25 and 27, Applicants note that each ultimately depends from one of claims 13 and 26, which define over the prior art, as discussed in detail above. Therefore, claims 14 – 25 and 27 also define over the prior art for at least the same reasons with respect to claims 13 and 26, and reconsideration and withdrawal of the rejections are respectfully requested.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

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